Risk Assessment

Using Nesting Bird to Test Predictions from Ecological Risk Assessments

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We are studying cavity-nesting western bluebird populations around LANL to confirm results of previous ecological risk studies. We are also developing and testing nonlethal indicators of ecological risk that can be applied to multiple spatial scales of assessment.

To prepare for the field tests, we applied a hazard quotient (HQ) model to 4,000 sampling locations and obtained an index of relative hazard across LANL. Using this relative-hazard index, we ranked the relative exposure of the western bluebird to environmental contamination in the LANL area. We placed more than 425 nest boxes across the putative hazard gradient indicated by HQ values to test whether the HQ values correlate well with ecological risk measured at nest-box-to-landscape scales. To determine if exposure to contaminants had measurable effects on specific variables, we measured nesting growth rates, developmental asymmetry, immune system function, parasitism, and survival. In parallel, we conducted laboratory experiments to explore relationships between environmental stress and bio-indicator response levels in more detail.

Our results indicate that contaminants did not have an adverse effect on nestling survival. It is likely that the difference between predicted and measured risk can be explained by differential bio-availability between chemicals in the environment and the toxicity threshold values, which were not considered in the HQ model. Measurements of developmental stability from two laboratory studies and the nest-box field work demonstrated a cost of producing antibodies when nestlings were confronted with non-pathological immunological challenges. This result is relevant to assessing the impacts of multiple stressors, such as disease and contaminants, for ecological and human health risk assessment. Spatial variation in bluebird nestling survival within years was detected across the Los Alamos landscape. We are developing analysis approaches that account for spatial autocorrelation of measurements to ascertain whether variation in survival is a function of stress caused by contaminants or caused by other factors. We are currently working with the institutional environmental ecology group (ESH-20) to move this activity into the long-term surveillance program for the Laboratory.

Data Analysis and Visualization

Facility for Information, Management, Analysis, and Display (FIMAD)

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FIMAD supports requests from the ER Project and other Laboratory programs to locate, analyze, and visualize environmental data. Our hardware resources include a RAID 5-file server, large-format plotters, scanners, and a digitizing tablet. We primarily use ESRI's Arc/Info software products to create, serve out, and display spatial information. We manage the ER Project's spatial data sets, which include aerial photos, digital elevation models, and other geographic information. FIMAD recently set up several file servers for ER staff to retrieve and display FIMAD's spatial data on their desktop computers. This initiative has simplified customer access to these products.

In addition to providing spatial-data management and storage, FIMAD houses a cartographic production laboratory. The FIMAD geographic information systems staff produces high-quality maps for many projects, technical teams, and others who make technical or management decisions. Since FIMAD's inception, the cartographic production laboratory has produced over 9,000 original maps and over 28,000 map copies for customers within and outside Laboratory.